

Mosses New for Mindanao Island, Republic of the Philippines

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Twelve new moss records are reported for Mindanao; two of these, *Fissidens pallidinervis* Mitten and *Symphysodon longicuspis* (Brotherus) Brotherus are new records also for the Philippine moss flora. The re-classification of moss taxa from the phytogeographical category of Taiwan-Philippine (Luzon) endemics to Wallacean endemics is noted.

KEYWORDS: Asian mosses, bryophyte inventory, species distribution, Philippines, Mindanao Island, new records

The moss flora of Mindanao has gained the interest of bryologists in recent years (Tan et al. 2000; Lubos 2007; Linis 2010; Tan and Shevock 2014). The new focus on the Mindanao biota, including the mosses, is brought by the increasing knowledge of tectonic history of this island which plays an important role in the evolution of the biotic diversity of the Philippines and the adjacent island groups in Malesia (Hall 1998; Michaux 1991; Tan 1992). Today, the island of Mindanao at 104,630 km² harbors a significant number of Gondwana species of plants in the Philippines that are not found in other island groups in the country (Linis and Tan 2008; Tan and Shevock 2014).

Fortunately, Mindanao still has, at present, plenty of mossy forests left on its high mountain peaks that preserve much of the bryophyte diversity in the country (figs. 1–2). Furthermore, the island has a small group of active resident botanists documenting the local plant diversity. They have collected, over the years, a number of new and noteworthy moss specimens representing hitherto unreported taxa from various provinces on the island. We report below twelve new moss records for Mindanao; two of these, *Fissidens pallidinervis* Mitten and *Symphysodon longicuspis* (Brotherus) Brotherus are new records also for the Philippine moss flora. Serving as Part II of Tan and Shevock (2014), the present report follows the same format and style in the listing of new species records of Mindanao mosses.

1. *Clastobryopsis robusta* (Brotherus) M. Fleischer [Sematophyllaceae]

This is widespread Malesian moss species, reported here for the first time from Mindanao, is characterized by having many expanded, somewhat complanate, and attenuated branch terminals that produce plenty of filamentous propagules in leaf axils. This species is rather large in plant size among its congeners and can be recognized further by having broad, decurrent leaf bases, recurved upper leaf margins with strong marginal teeth, and, a heterophylloid alar organization (cf. Tan and Jia 1999). In the Philippines, *Clastobryopsis robusta*, which is an epiphyte of small branches in forest canopy, is also widespread on Luzon Island and islands of the Visayan group.



FIGURE 1. In Mindanao typical mossy forests are primarily restricted to steep mountainous areas generally exceeding 1500 m in elevation. At this elevation, ample precipitation forms cloud forest environments ideal for bryophyte cover. The amount of water retained by bryophytes in such forests can be significant. Photo by J. Shevock.



FIGURE 2. High quality cloud forest habitat draped in bryophyte cover. Collecting in high quality forests is primarily limited to existing roads and trails. Cross-country travel is difficult and slow due to dense forest vegetation and steep slopes. Bryophytes colonize a wide variety of habitats from soil, litter, rotten wood, and boulders on the forest floor to shrubs, tree trunks, to small branches and twigs up in the forest canopy. Inventory efforts to document the diversity of species present at any location need to sample all of the available microhabitat conditions. Photo by J. Shevock.

SPECIMEN EXAMINED.— Bukidnon Province. Mt. Kitanglad Range Natural Park, on branch in forest, 6 Sep 2007, *Azuelo et al. s.n.* (CMUH, UC).

2. *Dendrocyathophorum paradoxum* (Brotherus) Dixon [Hypopterygiaceae]

The genus and the species are easy to identify in the family Hypopterygiaceae. The complanate and dendroid plant with irregular branches and leaves arranged in three rows characterizes *Dendrocyathophorum*. Treated as a monotypic genus in the recently published *Flora of China* (English Version) (Jia et al. 2002), our report extends the local range of *D. paradoxum* from Luzon to Mindanao in the country. The species has a scattered distribution across tropical and subtropical Asia, including Malesia.

SPECIMEN EXAMINED.— Misamis Oriental Province. Mt. Balatukan near Gingoog City, on tree trunk, 22 Oct 2005, *Padayao 22 b* (CMUH 02, UC).

3. *Elmeriobryum philippinense* Brotherus [Hypnaceae]

[syn. *Gollania philippinensis* (Brotherus) Noguchi, *Elmeriobryum assimile* Brotherus, *Elmeriobryum brotheri* R.S. Williams ex Brotherus]

In a very recent revision, the genus *Elmeriobryum* Brotherus was shown to consist of two species in Asia, namely, *E. philippinense* found in continental China (Guangdong Province), Taiwan and the Philippines, and *E. wilhemense* (E.B. Bartram) W.R. Buck & B.C. Tan, restricted to Papua New Guinea (Buck and Tan 2007; Higuchi 1985). The two species were stated to differ diagnostically in their plant size and altitudinal range (Buck and Tan 2007). A good illustration of *Elmeriobryum philippinense* is shown in Higuchi (1985, as *Gollania philippinensis*).

For many years, *E. philippinense* was known only from northern Luzon, which is geographically close to Taiwan and mainland China, representing an example of the “Taiwan-Philippine (Luzon)” endemics. Yet, *E. philippinense* is now shown to be present also in Mindanao. See the report of *Trachypus longifolius* Noguchi below for a similar distribution pattern.

SPECIMENS EXAMINED.— Bukidnon Province. Mt. Kitanglad Range Natural Park, on tree trunk, 25 April 2009, *Azuelo s.n.* (CMUH, UC); *ibid*, epiphytic, 7 Sep 2007, *Azuelo s.n.* (CMUH 30, UC).

4. *Fissidens pallidinervis* Mitten [Fissidentaceae]

[syn. *F. garberi* Lesquereux & James, *F. minutus* Thwaites & Mitten, *F. rizalensis* E.B. Bartram]

Fissidens pallidinervis is a nearly pantropical and a micro-*Fissidens* species that is characterized by having pluripapillose laminal cells, obtuse to round leaf apices, and limbidia restricted to vaginant laminae. In many recent publications, Philippine specimens of *Fissidens* with pluripapillose laminal cells, obtuse leaf apices and a percurrent leaf costa are treated as one broad taxon, *F. microcladus* Thwaites & Mitten (see Tan and Iwatsuki 1991). Pursell et al. (1993) made a clarification of the species concept of this confused group of taxa and regrouped them into two separate species, i.e., *F. pallidinervis* and *F. gardneri* Mitten (syn. *F. microcladus*). The main difference of these two segregated species lies in the size of the two vaginant laminae on the leaf (Pursell et al. 1993). Good illustrations of the two species are presented by Pursell (2007).

The new Mindanao collection reported here is identified as *Fissidens pallidinervis*. It is a new species record for Mindanao. Because of the past taxonomic confusion, its distribution in Luzon and Visayan Island groups needs a clarification.

SPECIMEN EXAMINED.— Bukidnon Province. Mt. Kitanglad Range Natural Park, on soil, *Azuelo et al. s.n.* (CMUH).

5. *Holomitrium cylindraceum* (P. Beauvois) Wijk & Margadant [Dicranaceae]

[syn. *H. vaginatum* (Hooker) Bridel, *H. javanicum* Dozy & Molkenboer]

The genus is distinctive in the family Dicranaceae in having rather large perichaetial leaves enfolding $\frac{1}{3}$ the length of the seta. The leaves have round to oval, thick-walled laminal cells, and the leaf alar consists of numerous quadrate, also thick-walled and colored cells. The habit illustration of this species in Gao et al. (1999, Plate 49) with long acuminate leaf apices is misleading. Accurate illustrations of this species are found in Fleischer (1904, as *Holomitrium javanicum*), Bartram (1939, as *H. vaginatum*) and Eddy (1988, as *H. vaginatum*). The species has a wide distribution from eastern Africa to Malesia and Polynesia (Eddy 1988). Before the present report of this species from Mindanao, *Holomitrium cylindraceum* had been reported from Luzon and Mindoro (Tan and Iwatsuki 1991).

SPECIMENS EXAMINED.— Bukidnon Province. Mt. Kitanglad Range Natural Park, on trail to Mt. Kitanglad, 17 Nov 2008, *Azuelo 112* (CAS, CMUH); Mt. Kalatungan, San Guinto, Barangay Bacusanon, on decayed log, 27–29 Dec 2012, *Segumpan, Roble & Octaviano s.n.* (CMUH).

6. *Leiomela javanica* (Renauld & Cardot) Brotherus [Bartramiaceae]

This is a genus in Bartramiaceae that has long setaceous leaves with prorate leaf cells, sessile capsules, and reduced peristome teeth. Only one species is known in Malesia, based on a Philippine record from Luzon (Tan and Iwatsuki 1991). There are no previously published records for its occurrence on Mindanao until the present report.

SPECIMEN EXAMINED.— Bukidnon Province. Mt. Kitanglad Range Natural Park, mid slope along trail toward Mt. Kitanglad, on trunk of tree fern, 26 Apr 2009, between 2100–2610 m, *Azuelo 178* (CAS, CMUH).

7. *Mniomalia semilimbata* (Mitten) Müller Hal. [Phyllo Drepaniaceae]

This is a very distinctive moss characterized by asymmetrical leaf shape with a one-sidedly located midrib. *Mniomalia semilimbata* grows preferably on moist shaded substrates in forest. In the Philippines, this widely scattered Malesian moss previously had been reported from a few locations on Luzon (Tan and Iwatsuki 1991).

SPECIMEN EXAMINED.— Agusan del Sur Province. Philsaga Mining Corporation, Brgy. Bayugan, Rosario, on moist rock, Feb 2014, 200–500 m, *Raganas s.n.* (CMUH).

8. *Rhacocarpus alpinus* (C.H. Wright) Paris [Rhacocarpaceae]

The species can be recognized by the dull, yellowish brown coloration of the specimens. The appressed, thick and leathery leaves are also distinctive. It was known previously from only one locality in the Philippines, Mt. Halcon in Mindoro (Tan and Mandia 2001). Its presence in Mindanao fills in the distribution gap of this widespread Gondwana taxon in the country.

SPECIMENS EXAMINED.— Bukidnon Province. Mt. Kitanglad Range Natural Park, on summit ridge of Mt. Dulang-Dulang, boggy ridge along saddle, 9 Jun 2007, *Azuelo s.n.* (CMUH, UC); *ibid*, in small bog with *Sphagnum* and *Campylopus*, 2740 m, 24 Apr 2014, *Shevock, Fritsch & Opiso 44868* (CAS, CMUH, NY, PNH, UC).

9. *Symphyodon copelandii* Brotherus [Symphyodontaceae]

The genus is distinctive with its echinate capsules. Without the capsule, specimens of *Symphyodon* can be mistaken for *Chaetomitrium* or *Neckera* because of the prorate laminal cells and the

short double leaf costae. *Symphyodon copelandii* is the second species of the genus reported from Mindanao after *S. perrottetii* Montagne. The two species differ in the outline of their leaf apices being acute to bluntly and shortly acuminate in the former, and gradually acuminate in the latter. Good illustrations of these two species are found in He and Snider (2000). As currently documented, *Symphyodon copelandii* has a Wallacean range found in the Philippines and central part of Indonesia (Sulawesi and Lesser Sunda Islands).

SPECIMEN EXAMINED.— Bukidnon Province. Mt. Kalatungan, San Guinto, Barangay Bacusanon, on tree trunk at ca 2000 m, 28 Dec 2012, *Segumpan et al. s.n* (CMUH, UC).

10. *Symphysodon longicuspis* (Brotherus) Brotherus [Pterobryaceae]

The genus *Symphysodon* is recognized easily by its dendroid plant habit with attenuate branches. The leaves are concave, uncostate and with acuminate apices. *Symphysodon longicuspis* differs from its congeners in having a large plant size and slightly concave and narrowly lanceolate leaves with gradually narrowed and long acumen that is bordered with strong dentation. Its closest relative is alleged to be *Symphysodon neckeroides* (see Hyvönen 1989), which differs from this species in having a smaller stature and more strongly concave leaves with an abruptly narrowed short to long, toothed acumen.

Symphysodon neckeroides Dozy & Molkenboer var. *tjibodensis* M. Fleischer (1908) was noted to differ from var. *neckeroides* in having larger plant size with leaves having a gradually, not abruptly, narrowed long acumen. We suspect that the var. *tjibodensis* is a synonym of *S. longicuspis*.

Symphysodon longicuspis is reported to be an endemic of Papua New Guinea (Hyvönen 1989). Herein we report this as a new record for the Philippine moss flora. Its presence in Mindanao indicates the New Guinea connection of the Philippine moss flora.

SPECIMENS EXAMINED.— Bukidnon Province. Mt. Kiamo, on tree trunk in lower montane forest by a deeply shaded stream, 7 May 2014, *Tan 2014-271* (UC), *Shevock & Tan 45161* (CAS, CMUH, MO, UC).

11. *Trachypodopsis serrulata* (P. Beauvois) M. Fleischer var. *crispatula* (Hooker) Zanten [Trachypodaceae]

The taxon is characterized by having a robust plant size with subpinnate branches forming brownish mats on forest floor. The leaves are longitudinally plicate, unipapillose, uncostate, with long acuminate apex and strongly cordate leaf bases with marked alar differentiation (Zanten 1959). While the species is widespread in Malesia and in Luzon of the Philippine archipelago, the record is new to Mindanao Island both as a variety, species and genus.

SPECIMENS EXAMINED.— Bukidnon Province. Mt. Kitanglad Range Natural Park, on tree trunk, 7 Sep 2007, *Azuelo s.n.* (CMUH, UC); upper slope of Dulang-Dulang, on litter, snag and base of hardwood trunks, 2620 m, 22 Apr 2014, *Shevock 44819* (CAS, CMUH, MO, UC), 23 Apr 2014, *Shevock 44863* (CAS, CMUH, UC) and 2875 m, 24 Apr 2014, *Shevock, Fritsch & Opiso 44881* (CAS, CMUH, NY, UC).

12. *Trachypus longifolius* Noguchi [Trachypodaceae]

Among the species of *Trachypus* Reinwardt & Hornschuch, this species has a distinctive oblong-lanceolate leaf blade with very long, narrow and acuminate acumen (van Zanten 1959). Its previous Philippine record is from northern Luzon (Tan and Iwatsuki 1991). The range extension of this species from northern Luzon to southern part of the Philippines, and notably its presence in

Mindanao, suggests that it does not belong to the phytogeographical category of Taiwan-Philippine (Luzon) endemic group. Indeed, additional searches among the neighboring island groups south of Mindanao may show that this species actually has a broader range, representing, instead, the Wallacean biota or Central Malesian phytogeographical group (Vallejo 2011; van Welzen et al. 2011; Vane-Wright 1990).

SPECIMENS EXAMINED.— Bukidnon Province. Mt. Kalatungan, San Guinto, Barangay Bacusanon, on tree trunk at ca 2000 m, 19 May 2013, *A. Azuelo* 23 (CMUH, UC); North Catabato Province. Kidapawan City. Mandarangan Trail along slope from Site B of Geothermal Production Field of EDC to Agco Mahomanoy Mountain Resort, on hardwood tree trunk, 1430 m, *Shevock & Tan* 45067 (CAS, CMUH, UC).

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